Atoms and Atomic Structure

1) Atoms

   a) **Atom** = smallest unit of an element
      i) 1 drop of water contains 1 million million billion atoms ($1x10^{21}$)

   b) **Element** = substance that cannot be decomposed into another substance by chemical or physical means.
      i) **Example:** burning, breaking

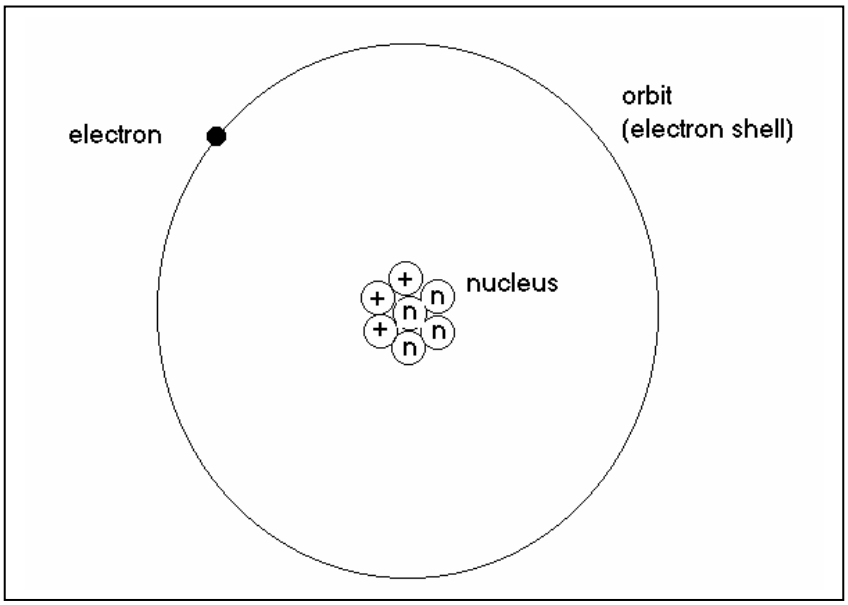
2) 109 elements --- 92 naturally occurring

3) 1 or 2 letter "atomic symbols" arranged in <u>periodic table</u>
   a) Some obvious: **O, H, Si, Al**
   b) Some not obvious: **Fe** (iron, L. *ferrum*), **Pb** (lead, L. *plumbum*), **Ag** (silver, Gk. Argyros [Argentina]), **Au** (gold, L. *aurum*)

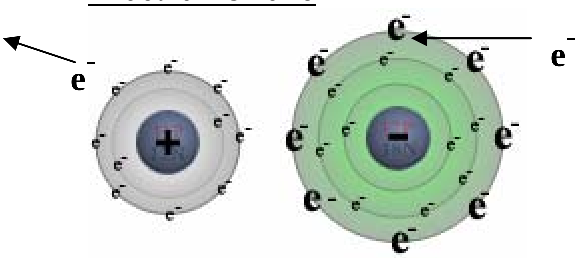
Atomic Structure

1) Bohr Model
   a) Three sub-atomic particles:

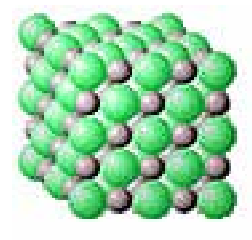
Particle	Charge
Proton	+
Electron	-
Neutron	-none-



Electron Shells



$^{1}Na^{+}$ $^{17}Cl^{-}$



Chemical Bonds

1) **Ionic** – electrostatic attraction between ions *(dating)*
   ”Electron transfer”

2) **Covalent –** sharing of “valence” electrons (*marriage*)

   a) Strong bonds: many mineral, including diamonds

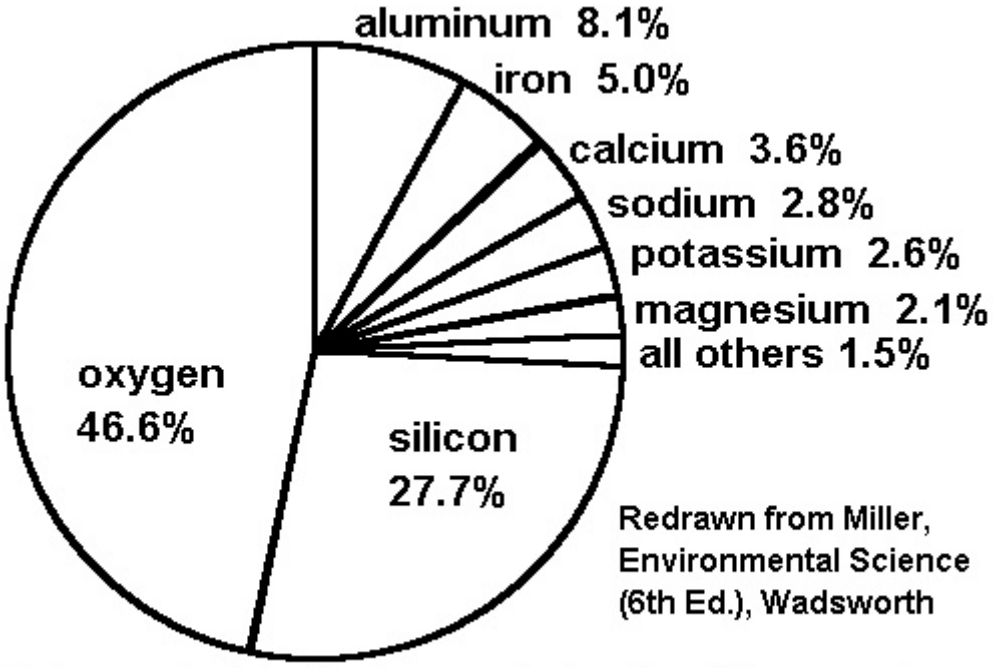
These next two we will not worry about

3) **Metallic** (rare) – too many orbital vacancies to fill, (*commune*)
   nuclei packed tight in a “sea” of electrons

   a) Good conductor of heat and electricity
   b) Malleable (hammer out flat) mallet=hammer
   c) Opaque

4) **Van der Waals** (rare) – polarized molecules attracted to one another

8 Elements make up 98.5% of the earth by weight



% by weight of elements in Earth's crust

Mineral = a naturally occurring, inorganic solid with a definite chemical composition and orderly internal atomic arrangement.

Mineral Groups

Silicates: Most common rock-forming minerals are silicates. A combination of oxygen and silica that form silicon-oxygen tetrahedron (SiO_4)

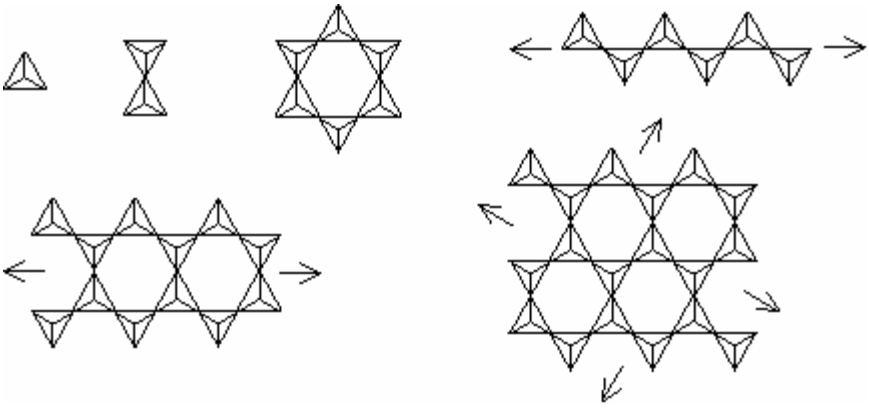
Independent tetrahedra — olivine

Single chain — pyroxenes

Double chain — amphiboles

Sheet silicates — micas

Framework silicates — quartz and feldspar



Carbonates : have CO_3 polyatomic ion – calcite $CaCO_3$ and dolomite

Oxides : oxygen – corundum, hematite and magnetite (ice!)

Sulfides: S_2 – galena and chalcocite

Sulfates : SO_4 – gypsum, barite

Native elements: gold, silver, copper, diamond

Phosphates: PO_4 – apatite

Halides: “salts” – halite, fluorite